

# NSF Fiscal Year 2002 Budget Request

This article is the 29th in an annual series of reports outlining the president's request to Congress for the budget of the National Science Foundation. Last year's report appeared in the June/July 2000 issue of the *Notices*, pages 668-670.

In early April 2001, President Bush sent to Congress his fiscal year 2002 budget request. For the scientific community the request was deeply disappointing. Apart from the National Institutes of Health, whose budget is slated to rise 13.5%, science funding in nearly all federal agencies would remain flat or decline under the request. In particular, the National Science Foundation (NSF) would get just a 1.3% increase—effectively a cut, given the inflation rate of 3.4% (as measured by the Consumer Price Index). Over the last few years, the scientific community helped to build a bipartisan consensus among members of Congress and the Clinton administration about the need to increase funding for science overall and also to achieve the right balance between funding for biomedical research and funding for the rest of science. As a result, increases for the NSF in recent years have been strong. But this year, said AMS Washington Office director Samuel M. Rankin III, “we’re going backwards.”

For mathematics the situation is especially frustrating. Over the past year or so momentum has built at the NSF for a big increase for mathematics. Last October the policymaking body of the NSF approved a major new initiative in the mathematical sciences.<sup>1</sup> No dollar amounts were formally stated, but NSF director Rita Colwell said she hoped to bring spending on the mathematical sciences to \$400-500 million per year over the coming five years, which is around four or five

times the current amount. Such a rise would depend on the NSF obtaining healthy increases—which it would not, under the terms of the fiscal year 2002 request. Still, the requested increase of \$20 million, or 16.5%, for the NSF’s Division of Mathematical Sciences (DMS) is clearly a positive sign when seen in the context of the flat or negative budgets for other divisions across the foundation. As DMS director Philippe Tondeur put it, “The mathematical sciences are disappointed about the low increase for the NSF, but we still appreciate the allocation to the DMS. This increase singles out the mathematical sciences for their fundamental role in science and their importance to society.”

## Low Funding for Science Criticized

Since releasing its budget request, the Bush administration has heard from many quarters that its plans for funding science are wrongheaded. In an Op-Ed piece in the *New York Times*, former presidential science adviser D. Allan Bromley took the administration to task for pursuing a “self-defeating policy” with regard to science. Members of both houses of Congress have also voiced concerns about such a small increase for science, especially for the NSF. It seems the Bush administration is starting to listen. “I think they’ve begun to realize they made a mistake,” Rankin observed. “The administration understands it has to do something about the balance of funding in science.” It is not a matter of overcoming any opposition to the NSF—indeed there is none—but rather of how budget priorities will be worked out as the government finds ways to pay for the president’s tax

<sup>1</sup>See “NSF Launches Major Initiative in Mathematics”, by Allyn Jackson, *Notices*, February 2001, pages 190-192; and “The Mathematical Sciences Initiative”, by Philippe Tondeur, *Notices*, March 2001, page 293.

cut and as the national economic slowdown begins to affect tax revenues.

Over the next several months Congress will go through the process of negotiating and writing the bills that actually appropriate money for government spending. This process could end up increasing the NSF's fiscal year 2002 budget above the level of the president's request, for the foundation has strong support among some influential members of Congress. One is Christopher Bond (R-MO), who, until the Democrats gained the majority in the Senate this spring, chaired the Senate Appropriations Subcommittee for Veterans' Affairs, Housing and Urban Development, and Independent Agencies. The NSF appropriation falls under this subcommittee. Earlier this year Bond wrote an amendment to the Senate budget resolution to increase the 2002 budget for the NSF. The resolution passed, and while it is not binding, it does express the sense of the Senate. One of the co-sponsors of the resolution was Barbara Mikulski (D-MD), who succeeded Bond as chair of the VA-HUD-Independent Agencies Appropriations Subcommittee. Mikulski has long argued for increased funding for the NSF and has called the 2002 request "unacceptable." Similar support for the NSF has been shown by some members of the House of Representatives. Visitors at the April 2001 meeting of the AMS Committee on Science Policy suggested that an increase of 7% might be a realistic outcome for the NSF. "If the NSF gets more money" through congressional action, said Rankin, "then we have to figure out how to encourage them to increase the amount in the mathematical sciences initiative."

### Highlights of the NSF Request

One of the highlights in the NSF fiscal year 2002 budget request is a new activity called Math and Science Partnerships, to be launched in the foundation's Education and Human Resources (EHR) directorate. Mandated by the Bush administration, this activity is part of the president's "leave no child behind" theme. One hundred twenty million dollars of the activity's \$200 million budget would come from reallocations within EHR, and the rest would be a combination of new funds and reallocations from other directorates. According to the NSF budget request document, "The Partnership initiative will provide funds for states and local school districts to join with institutions of higher education, particularly with their departments of mathematics, science, and engineering, to strengthen K-12 math and science education." There will be two kinds of partnerships, Infrastructure Partnerships and Action Partnerships. The former would work at the state level on broad-based activities such as teacher certification or aligning assessments to standards, while the latter would operate mostly at the local level,

pursuing such projects as adapting curricular models to local needs.

The request includes an increase of nearly \$8 million, or 8.8%, for graduate student support, including the NSF Graduate Research Fellowships. The additional funds will go toward increasing the fellowships from \$18,000 to \$20,500 per year. "Currently, the average stipend level for graduate students in science and engineering disciplines is less than half the average wage for bachelor's degree recipients," the budget document states. The hope is that the increase in the fellowship amount will help to stem a decline in the number of graduate enrollments in science. This decline has been felt in mathematics: According to the AMS-IMS-MAA Annual Survey, the number of first-year graduate students enrolled in doctoral programs in mathematics in the U.S. declined about 13% between 1991 and 1999. Mathematics is usually underrepresented among the NSF Graduate Fellows because a smaller proportion of mathematics students apply than in other areas of science and engineering.

The NSF is continuing its emphasis on a number of "priority areas": Biocomplexity in the Environment, Information Technology Research, Nanoscale Science and Engineering, and Learning for the 21st Century. These initiatives, some carried out in partnership with other federal agencies, take an interdisciplinary approach to major challenges in science and engineering. Thus they provide some opportunities for participation by mathematicians.

Another opportunity is offered by the NSF's Science and Technology Centers (STCs) program. This year's phase-out of twelve STCs will free up more than \$25 million for a new competition to launch an estimated six to eight new STCs. This competition will take place during fiscal year 2002. The NSF funded two STCs in the mathematical sciences: the Geometry Center at the University of Minnesota (for which NSF funding ended in fiscal year 1999), and DIMACS, the Center for Discrete Mathematics and Theoretical Computer Science (for which NSF funding ended in fiscal year 2000).

### Mathematical Sciences, "A Centerpiece"

In the description of the NSF's "core investments", the budget request document says that "Interdisciplinary Mathematics" is "a centerpiece" and will receive a \$20 million increase—exactly the amount of the increase for the DMS. "This emphasis on the mathematical sciences recognizes its increasingly critical role in advancing interdisciplinary science," the request states. "In FY 2002, NSF will focus on management of large data sets, the modeling of uncertainty, and the modeling and prediction of complex nonlinear systems." Tondeur said he does not wish to make a sharp distinction between

“fundamental” mathematics, meaning internal developments within the field itself, and “interdisciplinary” mathematics, which might involve interactions between different areas of mathematics or between mathematics and other areas of science and engineering. “Fundamental and interdisciplinary mathematics are inseparable agendas,” he said. “The emphasis at NSF is to advance the mathematical sciences as a discipline as well as to invigorate its strong connections with science and engineering. The goal is to explore partnerships that will advance both the mathematical sciences and these other areas.”

Among the main funding priorities for the DMS is the establishment of new institutes in the mathematical sciences. A competition is currently under way; the deadline was in January 2001, and the division received between ten and twenty proposals. The budget request says, “increased funding of \$7.0 million for the Mathematical Sciences

Research Institutes will provide support for up to four new Institutes in interdisciplinary mathematical sciences.” Tondeur confirmed that the DMS has not yet decided how many institute proposals will be funded. He noted that the time at which the decisions in the current institute competition must be made “dovetails nicely” with the time at which Congress will make the NSF appropriation—around the beginning of fiscal year 2002 on October 1, 2001. When Congress acts, the DMS will have a clearer idea of exactly what it can spend on new institutes.

Tondeur said that the other main funding priority for the DMS is the Focused Research Groups activity, through which small groups of researchers can apply for funds for collaborative research. The DMS has emphasized the VIGRE activity in recent years, but Tondeur indicated that, under the terms of the budget request, the DMS would not be able to significantly increase funding for VIGRE in the

**Table 1: National Science Foundation (Millions of Dollars)**

	1998 Actual	Change	1999 Actual	Change	2000 Actual	Change	2001 Plan	Change	2002 Request
(1) <b>Mathematical Sciences Research Support</b>	\$ 93.6	7.6%	\$ 100.7	5.3%	\$ 106.0	14.6%	\$ 121.5	16.5%	\$ 141.5
(2) <b>Other Research Support (Note a)</b>	2557.2	8.6%	2777.6	7.2%	2978.9	12.2%	3342.5	-1.8%	3281.8
(3) <b>Education and Human Resources (Note b)</b>	633.2	4.6%	662.5	3.2%	683.6	14.9%	785.6	11.0%	872.4
(4) <b>Salaries and Expenses (Note c)</b>	141.7	5.5%	149.5	3.6%	154.9	7.7%	166.8	6.0%	176.8
(5) <b>Totals</b>	\$3425.7	7.7%	\$3690.3	6.3%	\$3923.4	12.6%	\$4416.4	1.3%	\$4472.5
(6) (1) as a % of the sum of (1) and (2)	3.53%		3.50%		3.44%		3.51%		4.13%
(7) (1) as a % of (5)	2.73%		2.73%		2.70%		2.75%		3.16%

**Note a:** Support for research and related activities in areas other than the mathematical sciences. Includes scientific research facilities and instrumentation, and the Antarctic program. **Note b:** Support for education in all fields, including the mathematical sciences. Does not include funds collected through H1-B Nonimmigrant Petitioner receipts. **Note c:** Administrative expenses of operating the NSF, including the Office of the Inspector General.

**Table 2: Directorate for Mathematical and Physical Sciences (Millions of Dollars)**

	1998		1999		2000		2001		2002	
	Actual	% of Total	Actual	% of Total	Actual	% of Total	Plan	% of Total	Request	% of Total
(1) <b>Mathematical Sciences</b>	\$ 93.6	13.6%	\$100.7	13.7%	\$106.0	14.0%	\$121.5	14.3%	\$141.5	16.4%
(2) <b>Astronomical Sciences</b>	113.6	16.5%	118.5	16.1%	122.5	16.2%	148.6	17.5%	156.3	18.1%
(3) <b>Physics</b>	142.7	20.8%	162.7	22.2%	168.3	22.3%	187.5	22.0%	183.6	21.3%
(4) <b>Chemistry</b>	130.1	18.9%	135.3	18.4%	138.6	18.3%	153.5	18.0%	153.5	17.8%
(5) <b>Materials Research</b>	178.9	26.0%	186.4	25.4%	190.5	25.2%	209.7	24.7%	205.4	23.8%
(6) <b>Office of Multidisciplinary Activities</b>	28.3	4.1%	29.9	4.1%	29.9	4.0%	29.9	3.5%	23.4	2.7%
(7) <b>Totals</b>	\$687.2	100%	\$733.6	100%	\$755.9	100%	\$850.8	100%	\$863.6	100%

coming fiscal year. VIGRE, which stands for Grants for Vertical Integration of Research and Education in the Mathematical Sciences, supports innovative educational programs in which research and education are integrated and in which undergraduates, graduate students, postdoctoral fellows, and faculty work together. VIGRE is in its third year of funding, with around thirty grants active. It is not yet known how many more VIGRE grants will be funded in the next competition, the deadline for which is July 30, 2001.

Many are looking to Congress to improve the budget outlook for the NSF for the next fiscal year. Asked what his hopes are for the DMS budget, Tondeur did not specify a monetary figure. "My

dreams are big, but they are not the determining factor," he said. "All I can say is that I leave no stone unturned to get our budget increased." The talk of a big boost for mathematics funding raised the expectations of many in the mathematical community, and Tondeur said he received some "irate" letters from mathematicians saying that a \$20 million increase is not enough. But "it's not a good moment to complain," he pointed out, given that the foundation overall has such a small requested increase. It seems clear that, had the request been larger, the DMS would have done even better. That it got a reasonably good increase in a very lean request is perhaps the most encouraging sign of all.

—Allyn Jackson

**Table 3: Compilation of NSF Budget, 1996–2002 (Millions of Dollars)**

	1996 Actual	1997 Actual	1998 Actual	1999 Actual	2000 Actual	2001 Plan	2002 Request	1996–2000 Change	1996–2002 Change
<b>(1) Mathematical Sciences Research Support</b>	\$ 87.7	\$ 92.9	\$ 93.6	\$ 100.7	\$ 106.0	\$ 121.5	\$ 141.5	20.9%	61.3%
<i>Constant Dollars</i>	55.9	57.9	57.4	60.4	61.6			10.2%	
<b>(2) Other Research Support (Note a)</b>	2381.0	2447.2	2557.2	2777.6	2978.9	3342.5	3281.8	25.1%	37.8%
<i>Constant Dollars</i>	1517.5	1524.7	1568.8	1667.2	1729.9			14.0%	
<b>(3) Education and Human Resources (Note b)</b>	601.2	619.1	633.2	662.5	683.6	785.6	872.4	13.7%	45.1%
<i>Constant Dollars</i>	383.2	385.7	388.5	397.7	397.0			3.6%	
<b>(4) Salaries and Expenses (Note c)</b>	136.5	139.6	141.7	149.5	154.9	166.8	176.8	13.5%	29.5%
<i>Constant Dollars</i>	87.0	87.0	86.9	89.7	89.9			3.3%	
<b>(5) Totals</b>	\$3206.3	\$3298.8	\$3425.7	\$3690.3	\$3923.4	\$4416.4	\$4472.5	22.4%	39.5%
<i>Constant Dollars</i>	2043.5	2055.3	2101.7	2215.1	2278.4			11.5%	

Current dollars are converted to constant dollars using the Consumer Price Index (based on prices during 1982–1984).

For Notes a, b, and c, see Table 1.